Results from the National Water Monitoring Day Snapshot: Iowa's Picture

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On October 18, 2002, IOWATER monitors all over Iowa dipped test strips, transparency tubes, and thermometers into streams in an effort to assess the quality of streams across Iowa in the first statewide snapshot sampling event. A snapshot sampling is when multiple sites throughout a geographic area, such as a watershed or county, are sampled within a short period of time (e.g., eight hours). A snapshot provides a picture of water quality at one point in time and can be completed:

- To increase public awareness and involve the local community in water quality issues;
- To collect baseline data for a geographic area; and
- As a screening tool for identifying "hot spots" or streams that may contribute elevated concentrations of nitrate or other parameter of interest.

The samplings can be done:

- To learn more about various parameters of interest (i.e., sediment, nutrients);
- Using a combination of physical, chemical, and biological parameters, as well as observations about stream condition; and
- During different times of the year or different flow conditions (e.g., low-flow sampling during the fall may allow identification of septic system inputs that otherwise would not be as apparent under higher flow conditions).

Iowa's statewide snapshot sampling was held in conjunction with National Water Monitoring Day. A total of 68 sites were sampled across Iowa. This paper summarizes results from Iowa's portion of the National Monitoring Day Snapshot, and compares the data to streams sampled statewide during October as part of Iowa's long-term stream network. The attached maps show results from the National Monitoring Day snapshot sampling and the statewide network for October 2002.

National Water Monitoring Day Snapshot

October 18, 2002, marked the 30th anniversary of the passage of the Clean Water Act. To celebrate the event, volunteer monitors from across the U.S. were encouraged to test their waters as part of National Water Monitoring Day. The monitoring event was to provide a snapshot in time of water resources in the U.S. The event, the first of what is intended to be an annual event, was coordinated by America's Clean Water Foundation. Nationally, monitors were encouraged to measure water temperature, pH, dissolved oxygen, and water clarity/turbidity.

In Iowa, IOWATER monitors were encouraged to participate in National Water Monitoring Day by monitoring their regular sites between 10 am and 2 pm on October 18 and to complete any or all of the IOWATER field assessments. Data collected were then submitted to the IOWATER

database. Results from the sampling were intended to provide a picture in time of water quality in Iowa. (Note: The results below include only data submitted to the IOWATER database and none of the data submitted to the National Water Monitoring Day website. Since not all IOWATER monitors were able to sample on Friday October 18, this summary includes data submitted to the IOWATER database for sites monitored from October 16 through October 20.)

A total of 68 sites were monitored in 24 Iowa counties (Figure 1); three of the 68 stream sites monitored were dry. Two of the dry sites were in Lucas County in southern Iowa and have been dry since July 31, 2002 (note: since these two sites are relatively close to each other, the two sites appear as one site on the map); the other dry site was in Black Hawk County. Table 1 summarizes the results from the sampling. All samples were collected using standard IOWATER methods. For 10 sites, the October 18 sampling represented the first time these stream sites were sampled. All other sites have been monitored before, with some having been monitored 25 times or more.

pH

pH is a measure of a water's acidity. Changes in pH can be caused by atmospheric deposition of acid rain, the types of soils and bedrock that the water comes in contact with, wastewater discharges, and acid mine drainage. A pH of 7 is neutral; pH values greater than 7 are alkaline or basic, while a pH less than 7 is acidic.

pH levels from the IOWATER snapshot monitoring event varied from 7 to 9, with an average of 8 (Figure 2). The statewide stream network had pH values ranging from 7.2 to 8.9 for October 2002, with an average of 8.3. pH levels in Iowa streams typically fall within a very narrow range of 8.1 to 8.4. Of the 64 streams sampled as part of the snapshot sampling, 78% had a pH of 8 or 9.

Chloride

Chloride is a component of salt, and is a measure of human or animal waste inputs to a stream. Potential sources of chloride to a stream include direct input from livestock, septic system inputs, and/or discharge from municipal wastewater facilities. During winter months, elevated chloride levels in streams may occur as a result of road salt runoff to nearby streams.

Only 30 sites were sampled for chloride (Figure 3). The fewer number of chloride results reflects the difference in level of IOWATER training received by those who participated in the snapshot sampling. Chloride is an IOWATER Level 2 parameter, and only half of those who participated in the snapshot sampling have completed IOWATER Level 2 training. Chloride concentrations ranged from below detection (<25 mg/L) to 191 mg/L. The average chloride concentration was 30 mg/L, and is similar to chloride levels reported from the statewide stream network monitored during October 2002. Average chloride concentration for the statewide network for October 2002 was 23 mg/L, and concentrations ranged from 6.6 to 110 mg/L.

Three sites that were sampled as part of the IOWATER Monitoring Day Snapshot, a site in Black Hawk County, another in Dubuque County, and a third site in Johnson County, reported elevated chloride concentrations of 92, 150 and 191 mg/L, respectively. The site in Black Hawk County has been sampled on a monthly basis for the past year, and the 92 mg/L is the highest chloride level reported for this site to date. The site in Dubuque County has reported chloride concentrations above 100 mg/L for the past year. The IOWATER monitor for this site has noted livestock adjacent to this stream site. The site in Johnson County is downstream of a municipal wastewater facility. This is the first time this site has been sampled, although this site has been

used for IOWATER Level 2 workshops, and elevated chloride has been noted during those workshops. An elevated orthophosphorus value of 3 mg/L was also recorded at this site.

Orthophosphorus

Orthophosphorus is a necessary nutrient for plant growth. Too much phosphorus in surface waters, however, can cause nutrient enrichment, increasing aquatic plant growth, and changing the types of plants and animals that live in a stream. Sources of orthophosphorus include certain soils and bedrock; human and animal wastes; detergents; decomposing plants; and runoff from fertilized lawns and cropland.

Orthophosphorus concentrations ranged from 0 to 5.0 mg/L (Figure 4). The average concentration was 0.2 mg/L. Six sites reported orthophosphorus concentrations of 1.0 mg/L or higher. These sites were located in Black Hawk, Johnson, Linn, Polk, and Sioux counties. The site in Black Hawk County had an orthophosphorus value of 1.0 mg/L, a concentration that has been recorded at this site previously. The orthophosphorus level in the Johnson County stream was 3.0 mg/L. This was the first time this site has been monitored. The site is located downstream of a municipal wastewater outfall, and also reported elevated chloride levels (191 mg/L). The Linn County site had a value of 5.0 mg/L, a level that has also been measured at this site before. Two sites in Polk County had an orthophosphorus concentration of 1.0 mg/L. Both sites also had a nitrate-N value of 5 mg/L. The site in Sioux County has been monitored seven times since August 2000. Each time the site has been sampled, orthophosphorus values have been greater than 1 mg/L. Nitrate-N concentrations tend to be elevated at this site also, ranging from 2-10 mg/L. This site receives runoff or discharge from a golf course, a municipal wastewater facility, and a meat packing plant facility. All of these facilities are located in the watershed above the site, and all are within four miles of the monitoring site.

The average orthophosphorus concentration reported from the statewide network of stream sites that were professionally monitored during October 2002 was 0.12 mg/L. Orthophosphorus concentrations ranged from below the detection limit of 0.05 mg/L to 1.2 mg/L, with the higher concentrations scattered throughout all of Iowa.

Dissolved Oxygen

Dissolved oxygen levels in a stream can be affected by a number of variables, including water temperature, season of the year or time of day, stream flow, presence of aquatic plants, dissolved or suspended solids, and human impacts. Oxygen enters a stream through diffusion from the surrounding air and as a product of photosynthesis from aquatic plants. Oxygen in a stream can be consumed through respiration by aquatic plants and animals, and by the decomposition of organic matter.

The average dissolved oxygen for the sites sampled was 8 mg/L (Figure 5); the lowest dissolved oxygen value was 4 mg/L, recorded at a site in Mitchell County. This was the first time that dissolved oxygen had been measured at this site. Another site in Johnson County had a reading of 5 mg/L. This site has been monitored for dissolved oxygen on 14 different occasions, and low dissolved oxygen concentrations have been recorded previously at this site. Eight sites reported a dissolved oxygen concentration of 6 mg/L. These sites were scattered throughout the northeast quarter of Iowa and included one site in Polk County. For most of these sites, previous monitoring has reported similarly low dissolved oxygen levels.

Average dissolved oxygen concentration for the streams monitored professionally statewide during October 2002 was 8.9 mg/L. Dissolved oxygen concentrations ranged from 5.3 mg/L to

13.0 mg/L, with all sites reporting values greater than 5 mg/L. Sites with dissolved oxygen greater than 10 mg/L were primarily located in the northern one-third of Iowa.

Water Temperature

Water temperature affects many of the biological, chemical, and physical processes in a stream, including the amount of oxygen gas that can dissolve in water, the rate of photosynthesis by algae and plants, as well as the metabolic rate of aquatic animals. Human activities can adversely raise stream temperatures by releasing warmed water into a stream. These human induced increases in water temperature are known as thermal pollution. Examples of thermal pollution include industry discharges or runoff from paved surfaces; removal of trees from along streams, thus allowing direct sunlight to warm the water; or soil erosion, which causes an increase in suspended particles in water. These particles are able to absorb heat from the sun and increase water temperature.

Water temperatures from the snapshot ranged from 29 to 59 degrees Fahrenheit and the average was 48 (Figure 6). Most of the sites that had lower water temperatures were located in the Squaw Creek Watershed near Ames in Story County

The average temperature reported from the statewide network of stream sites that were professionally monitored during October 2002 was 60 degrees Fahrenheit. Water temperature ranged from 46 to 74 degrees Fahrenheit, with the warmer water temperatures primarily located in streams in the southern half of Iowa. The difference in temperatures between the IOWATER snapshot sampling and the statewide network of streams may be related to when each sampling occurred. The statewide network was sampled during the first two weeks of October, while the IOWATER sampling occurred the latter part of the third week in October. Statewide, air temperatures were above normal for the end of September and beginning of October, but quickly declined to below normal for most of October. October was the 5th coldest October on record based on 130 years of weather record in Iowa (http://www.agriculture.state.ia.us/climatology/weathersum1002.htm).

Nitrite-N and Nitrate-N

Nitrogen is a necessary nutrient for plant growth, and includes both nitrite- and nitrate-nitrogen. Too much nitrogen in surface waters, however, can cause nutrient enrichment, increasing aquatic plant growth and changing the types of plants and animals that live in a stream. Sources of nitrogen include soils; human and animal wastes; decomposing plants; and fertilizer runoff from golf course, lawns, and cropland.

For the snapshot sampling, nitrite-N concentrations ranged from 0 to 1 mg/L (Figure 7). The majority of sites had 0 mg/L or a very low concentration. More than 65% of the sites had 0 mg/L; only 5% of the sites had nitrite-N greater than 0.15 mg/L. Of the sites with elevated nitrite-N concentrations, the site in Johnson County usually has low (0.15 to 0.30 mg/L), but detectable levels of nitrite-N. A site in Sac County had a nitrite-N concentration of 1 mg/L; very few samples have been collected at this site, and the 1 mg/L is the highest concentration to date.

Nitrate-N concentrations ranged from 0 to 20 mg/L, with an average of 2 mg/L (Figure 8). The highest reported nitrate-N concentration was 20 mg/L at a site in Cerro Gordo County near Mason City. This concentration was the highest nitrate-N value ever measured for this site. Three sites had nitrate-N concentrations of 10 mg/L: one in Sioux County in northwest Iowa; a site in Story County in central Iowa; and a site in Fayette County in northeast Iowa. Elevated nitrate-N has been reported previously for the site in Sioux County, whereas the nitrate-N result

from the Fayette County site was the highest recorded to date for that site. The site in Story County has had elevated nitrate most of this year, with a high of 20 mg/L from July 2002.

The average nitrate-N concentration reported from a statewide network of stream sites that were professionally monitored during October 2002 was 3.4 mg/L. (Note: For the professional network, nitrate is reported as nitrate+nitrite-N.) Nitrate-N concentrations ranged from 0.1 to 17.0 mg/L, with the higher concentrations occurring in north-central Iowa.

Transparency

Transparency is a measure of water clarity and is affected by the amount of material suspended in water. As more material is suspended in water, less light can pass through the water, making it less transparent (or more turbid). These materials include soil, algae, plankton, and microbes.

A cluster of sites monitored in the Squaw Creek Watershed near Ames in Story County and another group of sites in and around the Shell Rock River area of Butler and Floyd counties all reported transparency values greater than 40 centimeters. Water transparency was high not only for these areas, but also for the majority of streams sampled, as 75% of the sites had a transparency of 50 centimeters or greater (Table 1; Figure 9). This was not unusual given the time of year and lack of rainfall prior to sampling. For one site in Butler County, the transparency reading of 51 centimeters was the highest reported for this site to date. The lowest transparency values were 17 and 19 centimeters for sites in Buchanan and Johnson counties, respectively. For the site in Butler County, 17 centimeters was one of the lower values reported for this site. For the site in Johnson County, past monitoring has reported similar low transparency measurements.

Transparency is not measured as part of the statewide network of streams, rather, turbidity is used as an indicator of the amount of sediment in the stream. Turbidity values ranged from 1.2 to 690 Nephelometric Turbidity Units (NTU), and the average was 20 NTU. (Note: The higher the turbidity reading, the more suspended material is in the water, compared to transparency where a lower transparency reading means that more suspended material is in the water.) The higher turbidity values were recorded at streams in western Iowa and across the southern half of Iowa, while the lowest turbidity values were for streams in northeast Iowa.

Table 1. IOWATER Statewide Snapshot Sampling Results for October 18, 2002.

Parameter	Unit	# of samples	Min Value	Percentiles			Max Value
				25th	50th	75th	
Water Temperature	degrees F	63	29	45	48	51	59
pH	pH units	64	7	8	8	9	9
Dissolved Oxygen	mg/L	65	4	8	8	10	12
Nitrite-N	mg/L	64	0	0	0	0.15	1
Nitrate-N	mg/L	65	0	1	2	5	20
Chloride	mg/L	30	<25	<25	30	36	191
Transparency	centimeters	59	17	51	60	60	60*
Orthophosphorus	mg/L	63	0	0.1	0.2	0.3	5.0

Note: Three sites that were monitored were dry: two in Lucas County and one in Black Hawk County.
**** The maximum transparency reading that can be recorded using the transparency tube is 60 centimeters.***

Future Statewide Snapshots

The IOWATER program gratefully acknowledges everyone who took their time to monitor sites as part of the statewide snapshot sampling. We plan to build upon the first statewide snapshot sampling by coordinating a biannual statewide snapshot sampling in the spring and fall of every year. Stay tuned to the *Iowa Citizen Monitor*, IOWATER's newsletter, for more details. The spring 2003 snapshot sampling is scheduled for Saturday May 24, 2003, and the fall sampling will be conducted again in October, in conjunction with National Water Monitoring Day.

Acknowledgements

Thanks to the following for their participation in the National Monitoring Day Snapshot Sampling and for submitting data to the IOWATER database: Jean Hagert Dow; Dieter Dellmann; James Heinz and Jefferson Junior High School students; Bruce Burroughs; Shirley Van Eschen; Andria Cossolotto and Atlantic High School students; Sam Hamilton-Poore; Kerry Krogh; Dana Lawrence; Cheri Hufford; Coleen Hughes and Dubuque Wahlert High School students; Charlie Winterwood; Richard Worm; Dave Carnahan and Table Mound Elementary School students; Lowell Dibble; John Black and Monticello High School Environmental Science students; Kim and Marsha Francisco; Bill Helgen; Irlanda Hoffman; Dale Adams; Debra Lyons and JMS 8th grade student; Charles Sayre and his wife; Curtis Lundy; Evan Degroot; Erwin Klass; Ken Shaw; Brian Vobr, Chad Kostohryz, and Brandon Riha of Crestwood High School Natural Resources class; Robert Basset; Gaylan and Lloyd Crim; Bell Tubbs; Karen and David Manning; Cheryl, Tyler, and Dillon Waskow; Lou Corones; Lisa Horsch and Block 2 Science; Bill Schwarz and Prairie High School students; Eric Dralle, Tim Ott, Jen Linskey, Steph Chase, Kelly Chisholm; James Martin, Kristen L., Jason H., Kristen G; and Vicki Wilson.

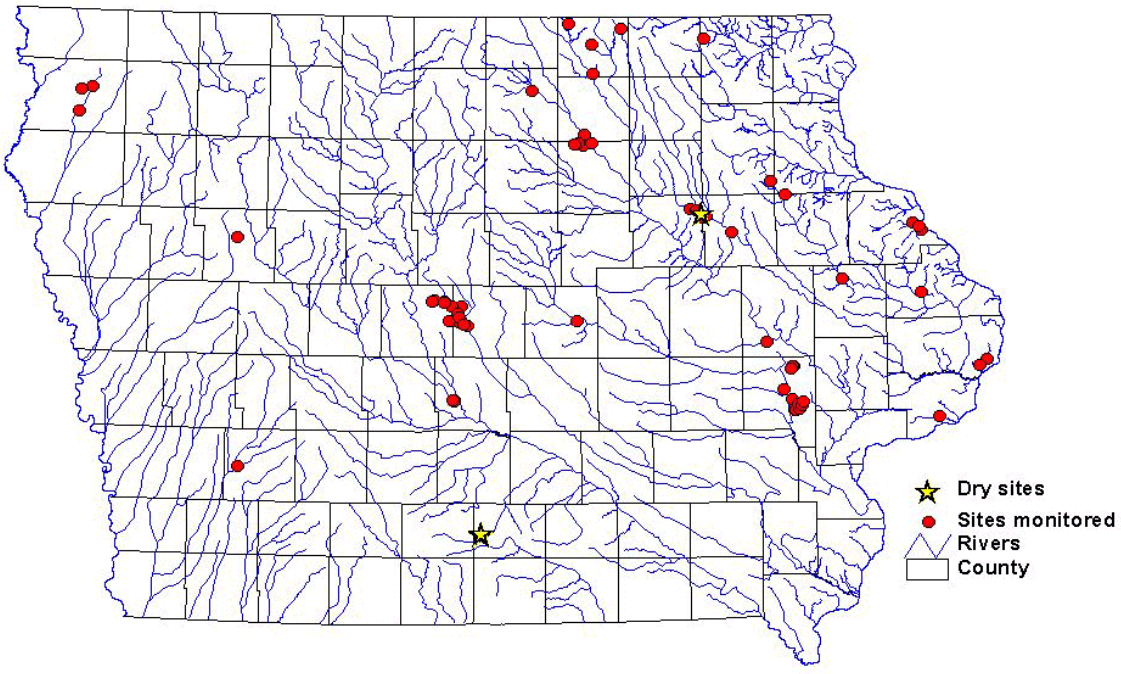


Figure 1. IOWATER Snapshot Results - Sites Monitored.

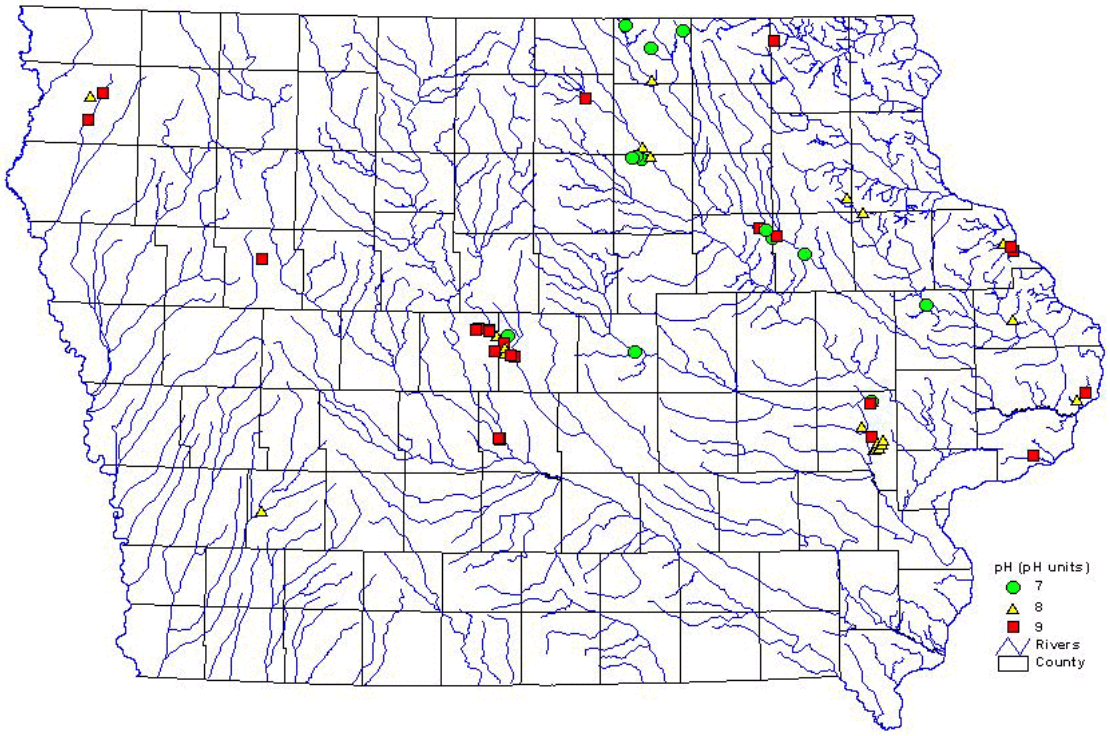


Figure 2. IOWATER Snapshot Results - pH.

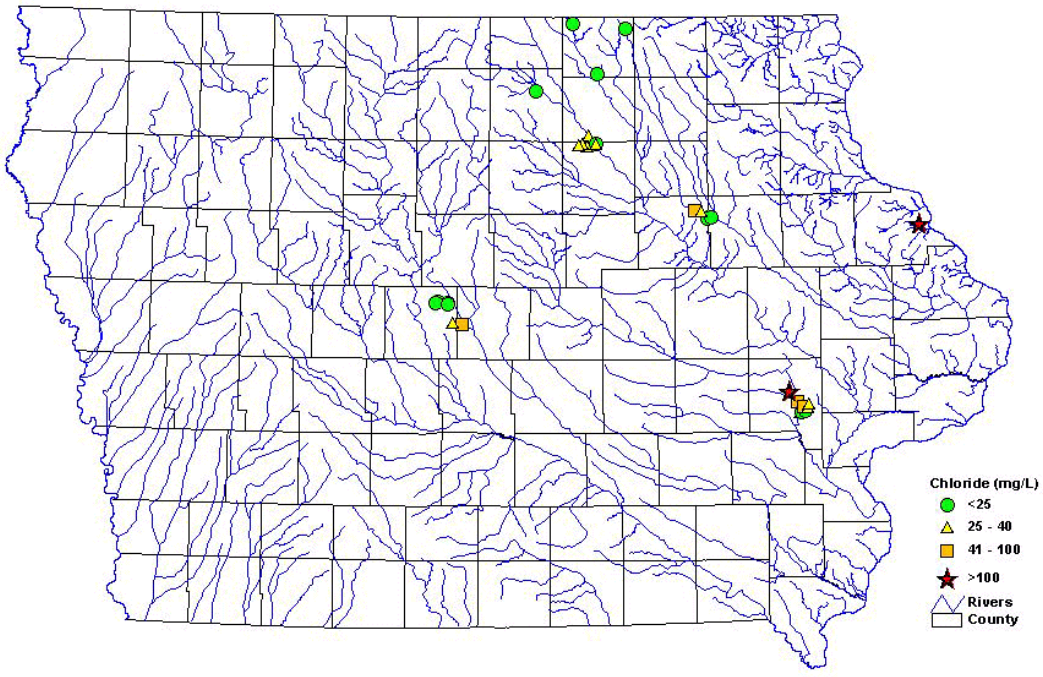


Figure 3. IOWATER Snapshot Results - Chloride.

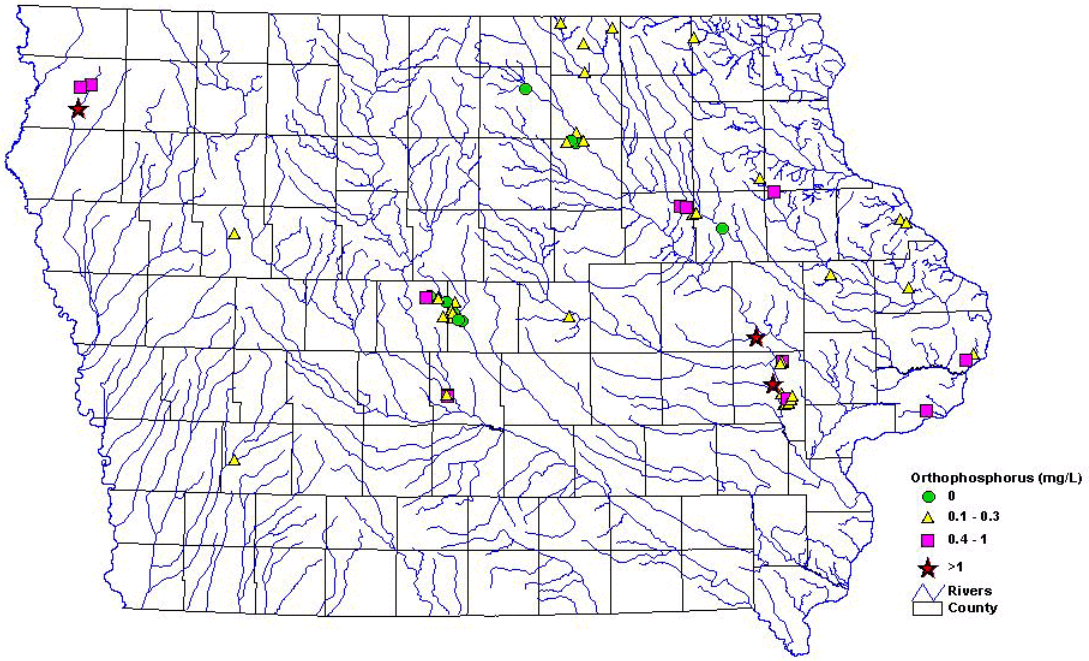


Figure 4. IOWATER Snapshot Results - Orthophosphorus.

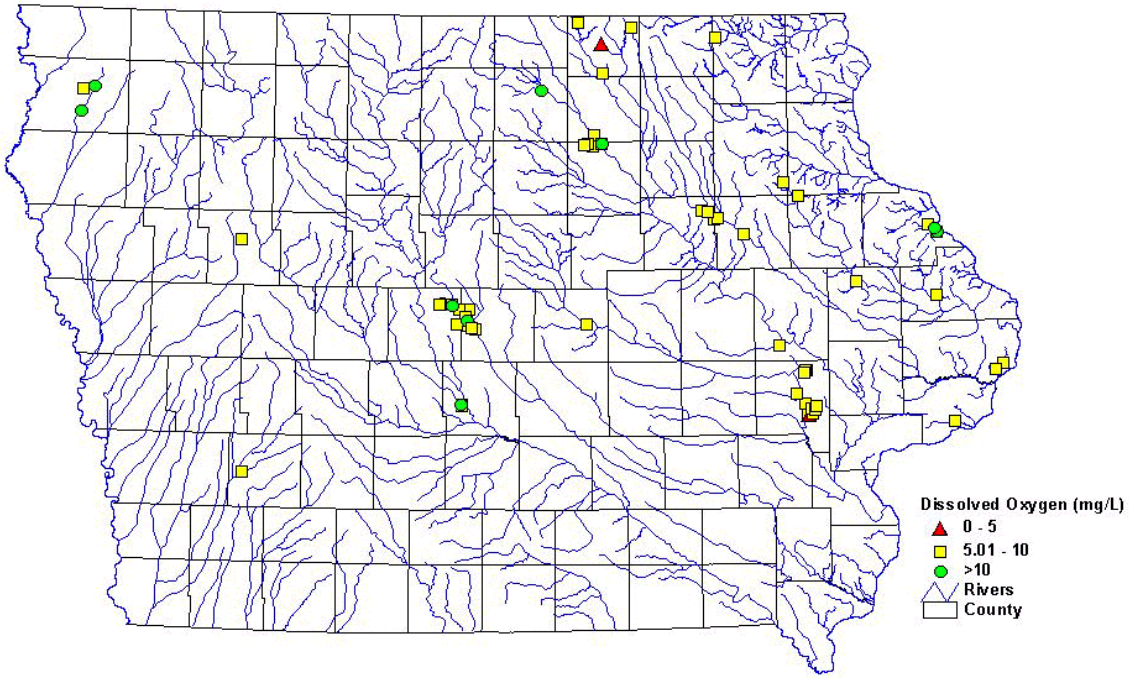


Figure 5. IOWATER Snapshot Results - Dissolved Oxygen.

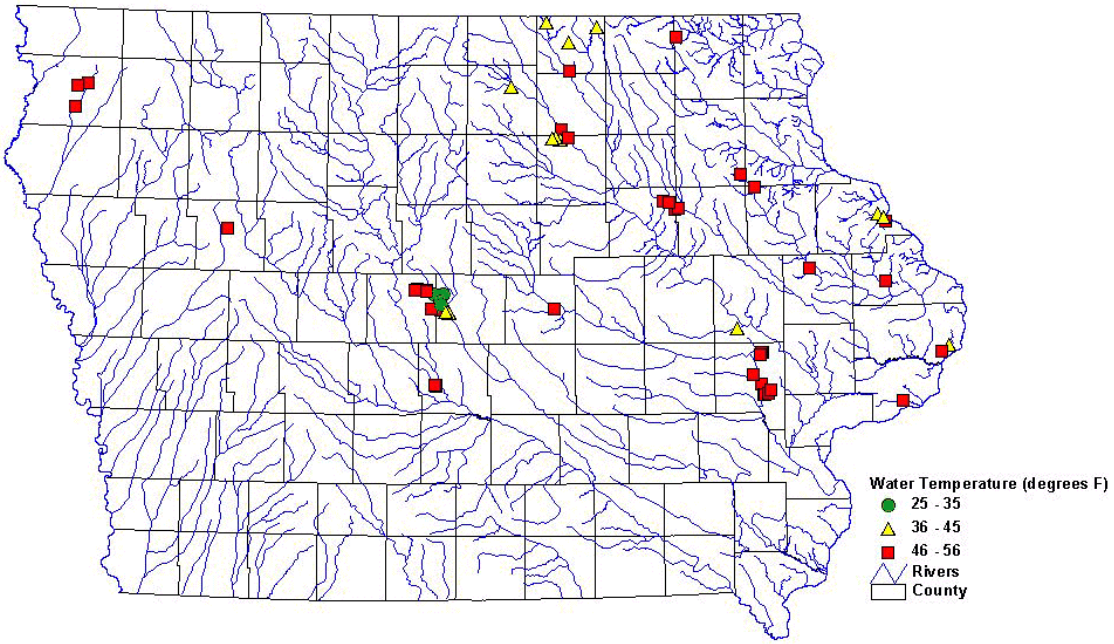


Figure 6. IOWATER Snapshot Results - Water Temperature.

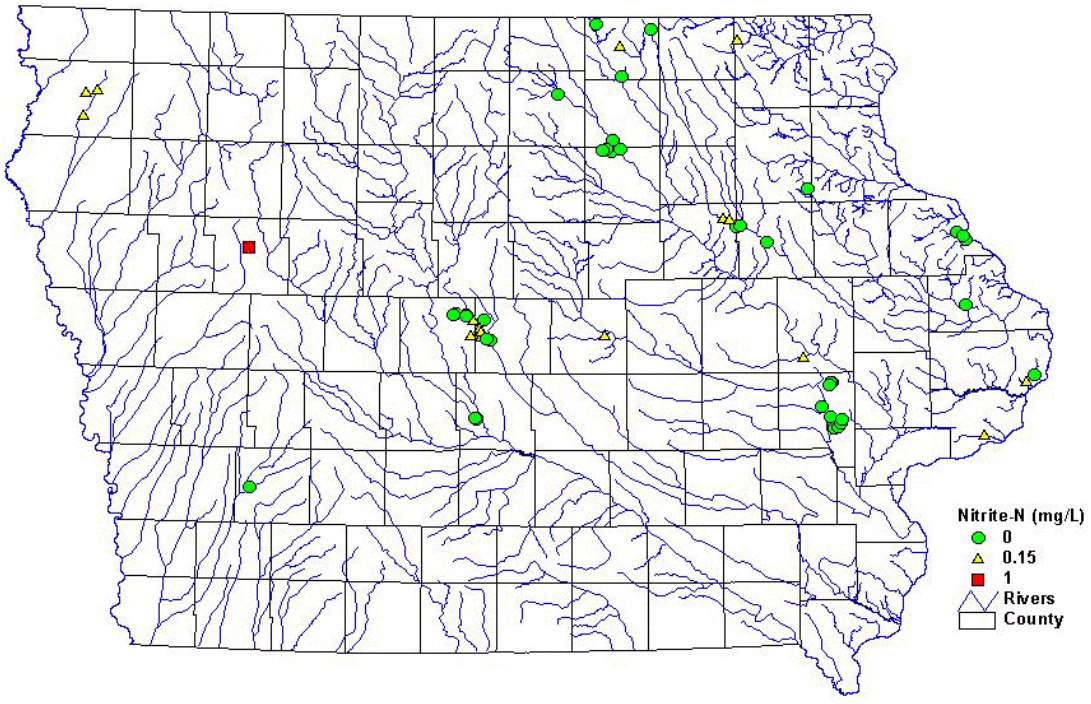


Figure 7. IOWATER Snapshot Results - Nitrite-N.

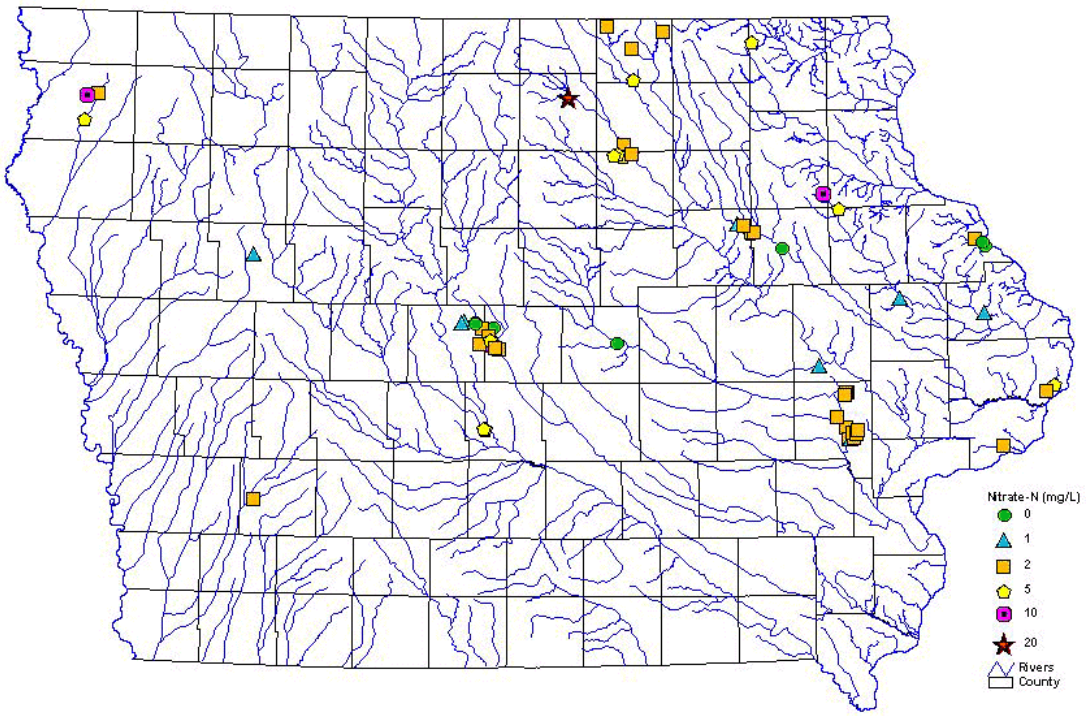


Figure 8. IOWATER Snapshot Results - Nitrate-N.

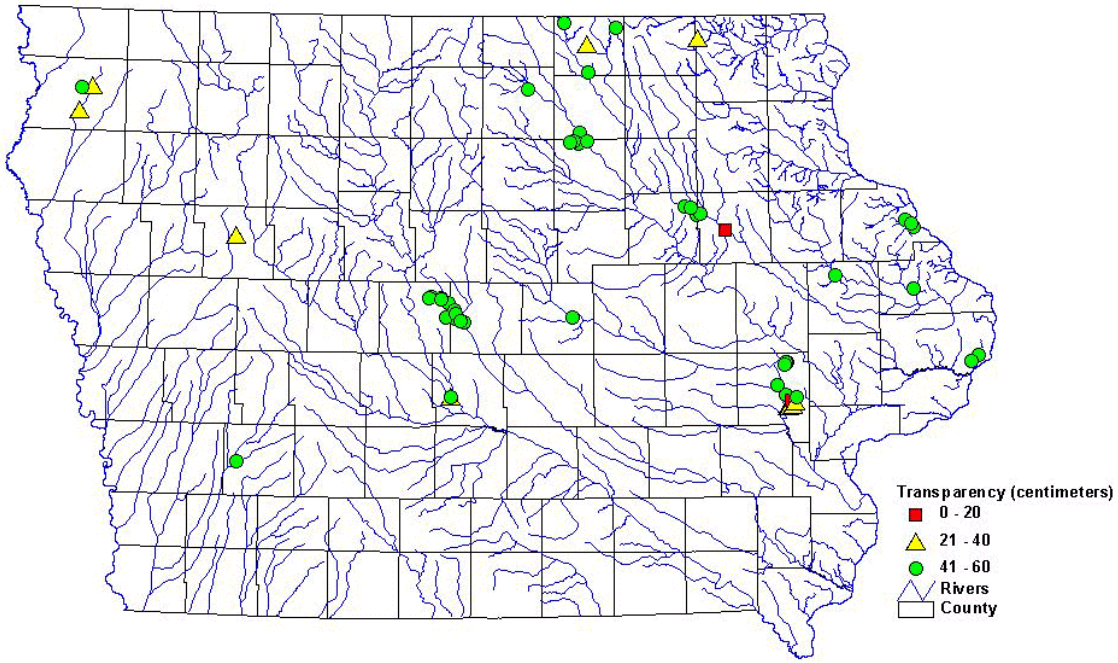
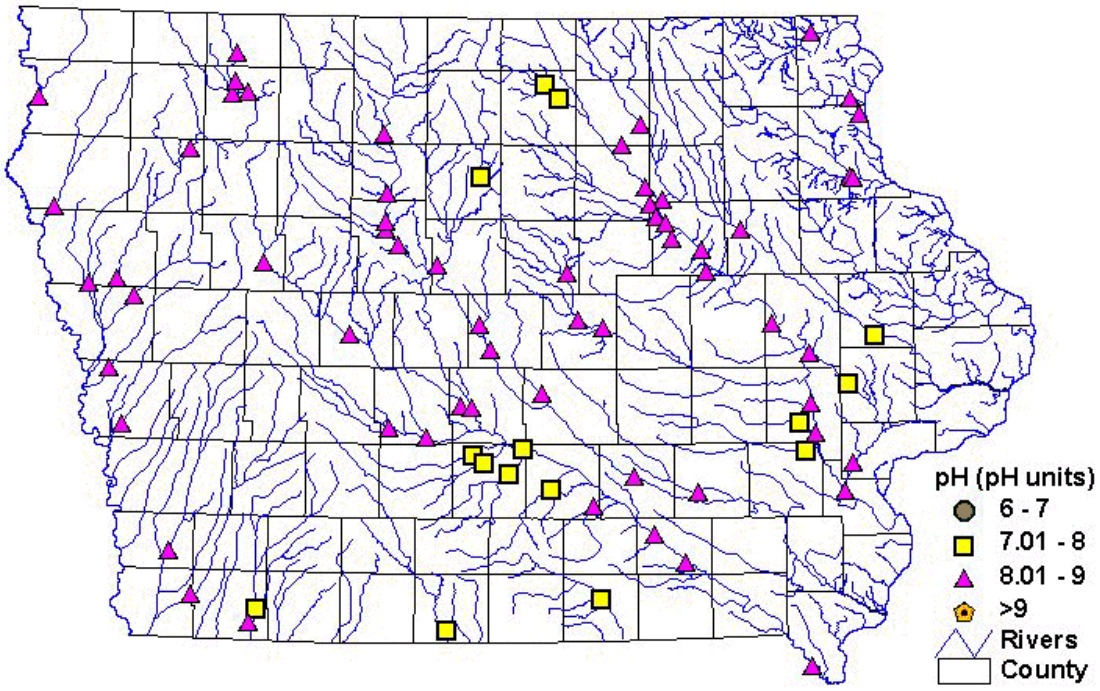
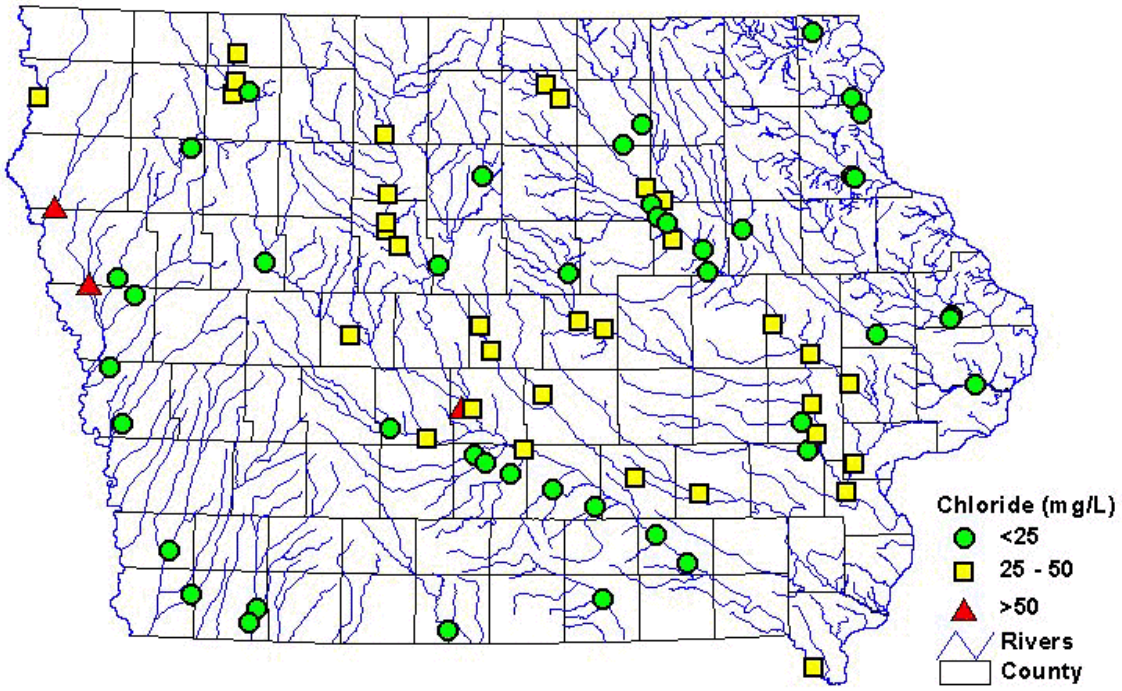
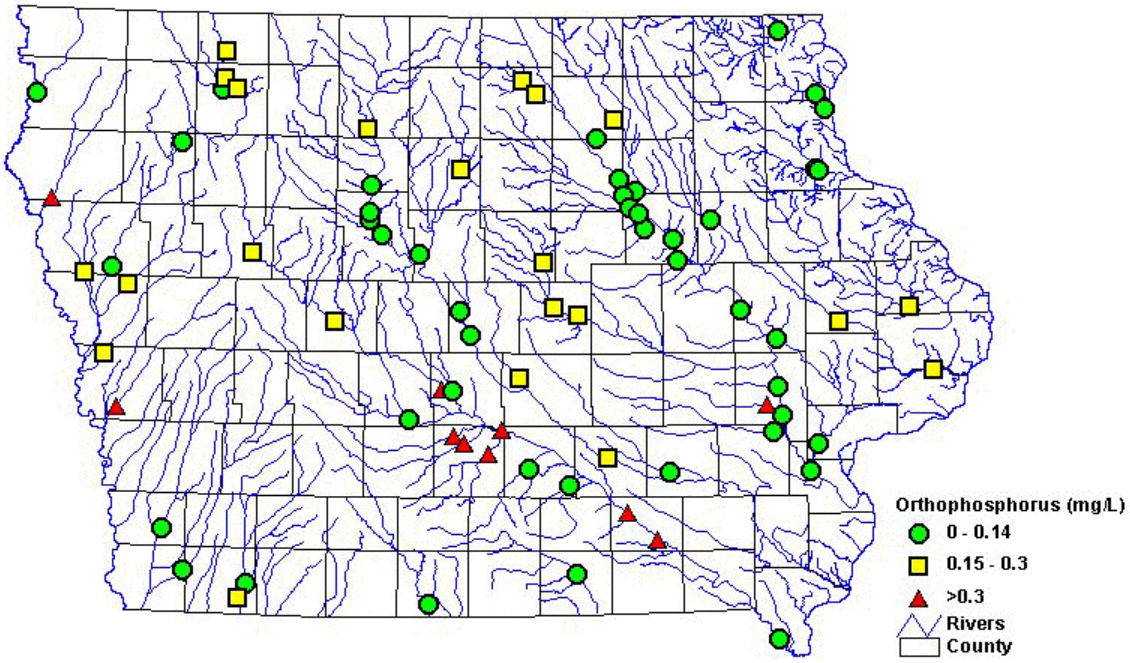


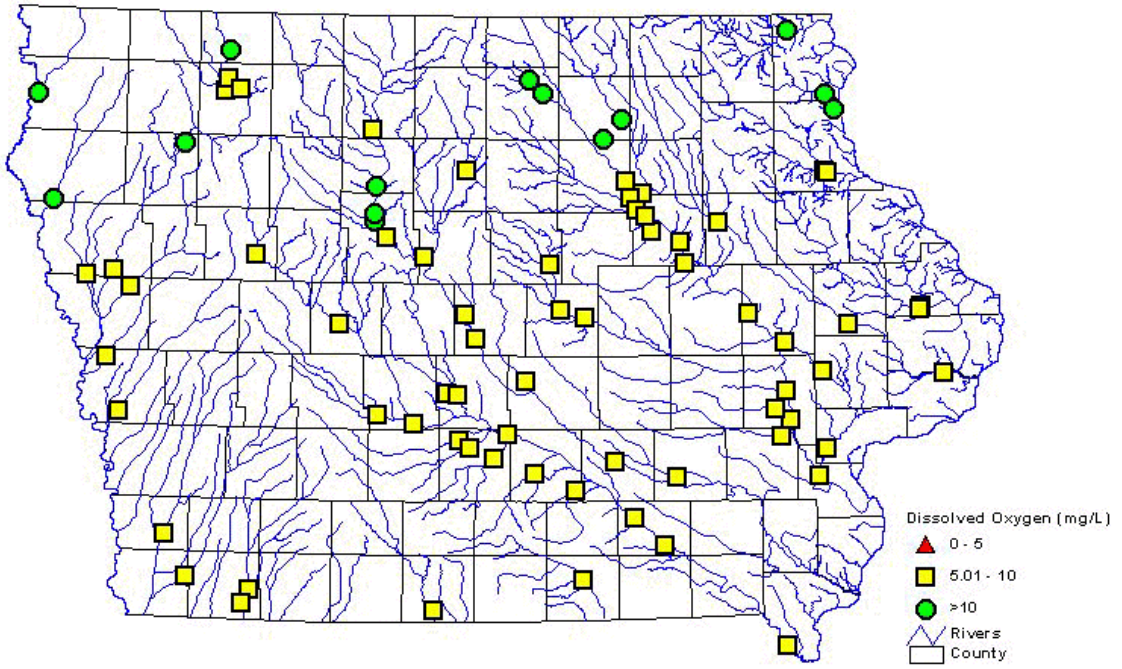
Figure 9. IOWATER Snapshot Results - Transparency.

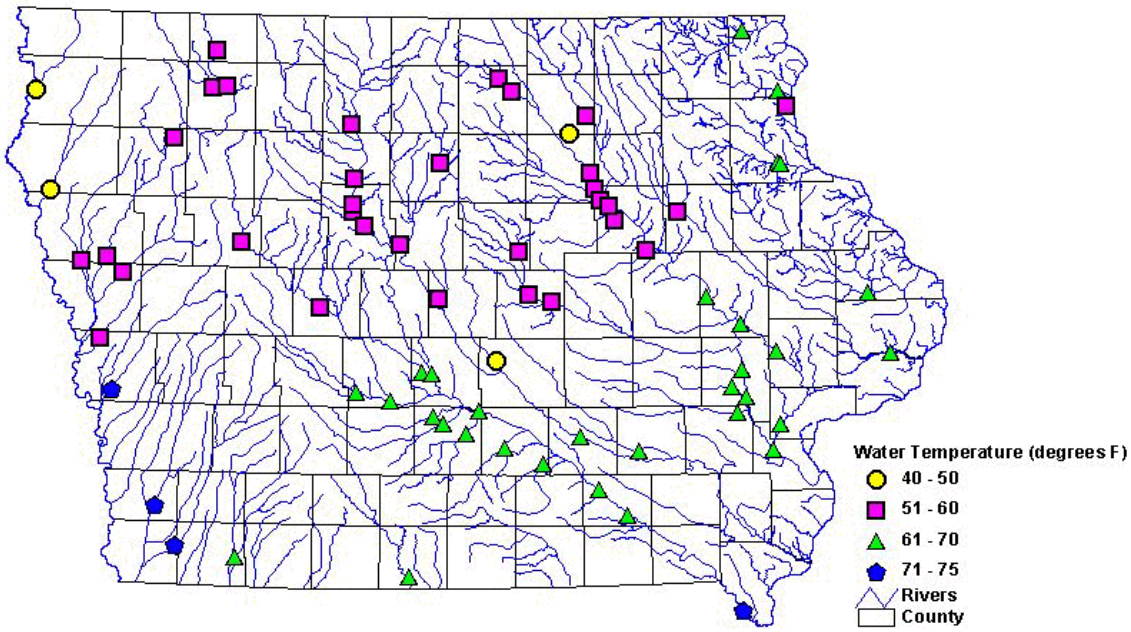
NOTE: The maps below show the October 2002 results from the 85 stream sites that are monitored on a monthly basis as part of Iowa's Ambient Water Monitoring Program. These maps are included to provide perspective for the National Water Monitoring Day results.

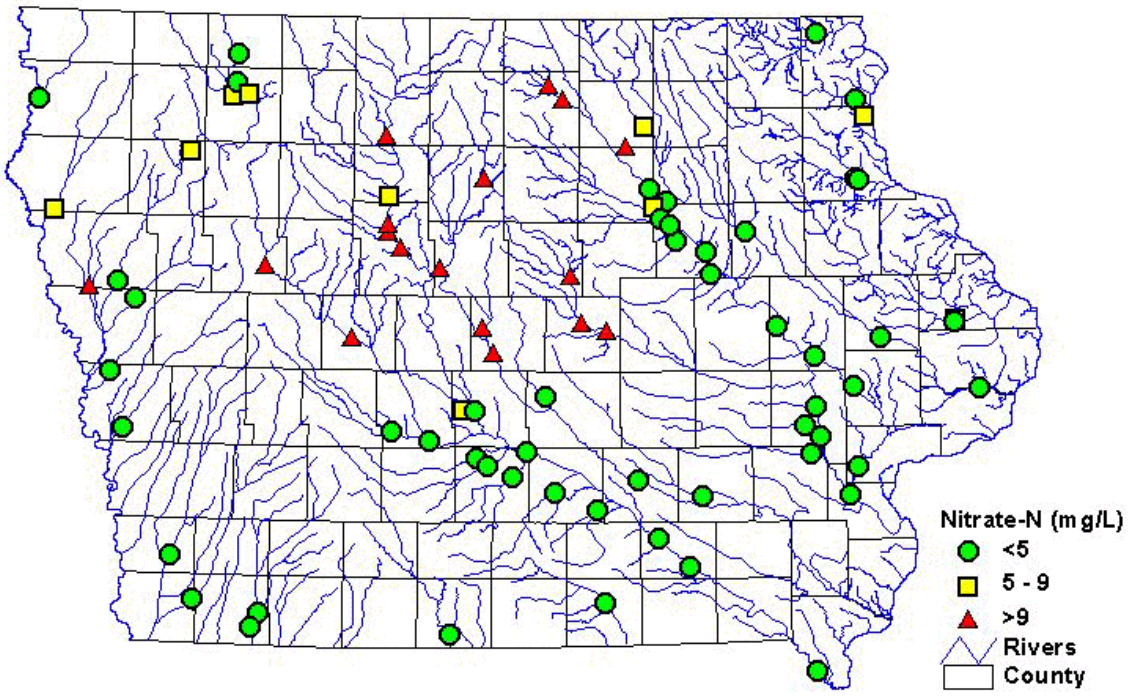


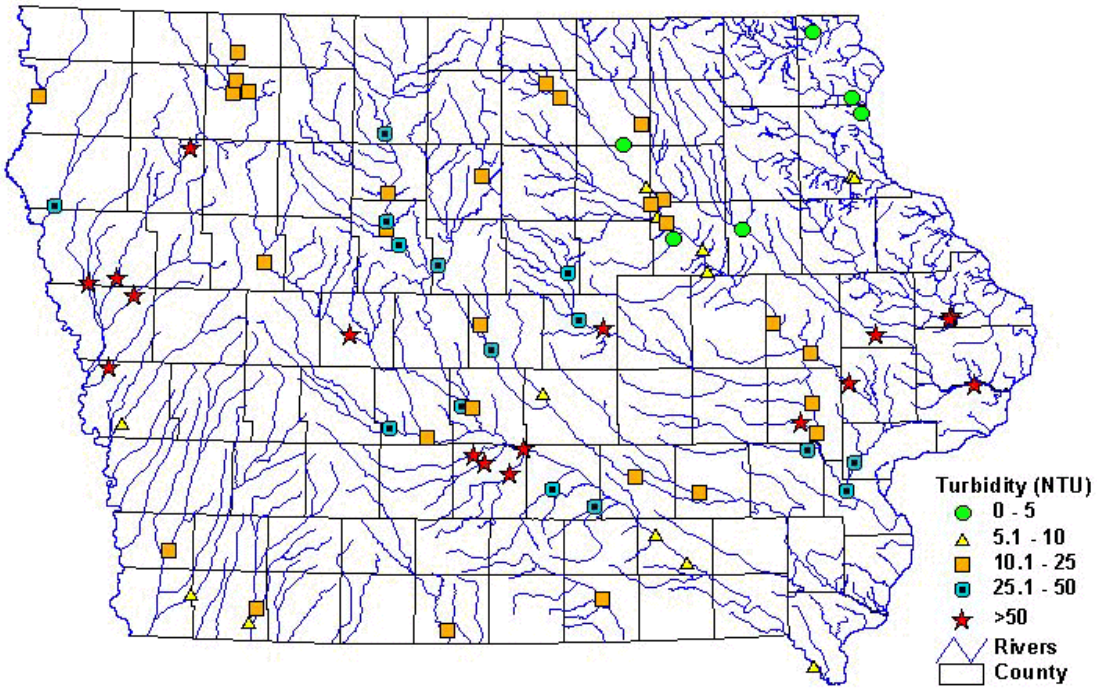

Chloride (mg/L)
<25
25 - 50
>50
Rivers
County


Orthophosphorus (mg/L)
0 - 0.14
0.15 - 0.3
>0.3
Rivers
County


Dissolved Oxygen (mg/L)
0 - 5
5.01 - 10
>10
Rivers
County


Water Temperature (degrees F)
40 - 50
51 - 60
61 - 70
71 - 75
Rivers
County


Nitrate-N (mg/L)
<5
5 - 9
>9
Rivers
County


Turbidity (NTU)
0 - 5
5.1 - 10
10.1 - 25
25.1 - 50
>50
Rivers
County